

# **Iowa Department of Transportation**

ROTATIONAL—CAPACITY TEST

Long Bolt Procedure 1-5-95
(For bolts long enough to be tested in a Skidmore.)

Test Number\_\_\_\_\_ Date\_\_\_\_\_ Inspector \_\_\_\_\_ Design #\_\_\_\_

(For bolts long enough to be tested in a Skidmore.)		Inspector	
County Project # [		Design	#
Skidmore Correction	Calcu	ılations	
Calb. Avekip Gaugekip Calb. Ave – Gauge =kip	Bolt diameter *D* =in. 4D =in. Min. Adj. Tension =	. 8D=	in.
Fastener Type BLACK GALVANIZED Legisler		Misc. In	formation
R – C PROCEDURE (I.M. 453.06 B)		TAE	SLE 1
Bolt Length = inches Rea  Corrected Skidmore Tension (P) =	ad kips kips	Bolt Dia.	Initial Tension Range
(Must be = to, or > than TABLE 2  Measured Torque =ft-lbs	,	3/4" 7/8"	3 to 5 kips 4 to 6 kips 5 to 7 kips
Max. Permitted Torque =ft-lbs T=0.25x  T < 0.25 x dia/12 x P Measured < Max OK?	" xlbs	1-1/8"	6 to 8 kips
		TAB	SLE 2
*** Complete R – C Test Rotation. ***  (Should bring total rotation to 2x the rotation required by Turn-of-Nut.) Re	adkips	Bolt Dia.	Specification Min. Tension
Corrected Skidmore Tension =	•	3/4"	28.4 kip
(Must be > than TABLE 3 Tension)	-	7/8"	39.3 kip
Condition of Fastener: Nut OK? Bolt OK?	PASS?	1"	51.5 kip
		1-1/8"	56.5 kip
Production Lot# NOTES:		TAB	SLE 3
Bolts Nuts		Bolt Dia.	Min. Adj. Tension
Washers R – C Lot #		3/4"	32.7 kip
		7/8"	45.2 kip
		1"	59.2 kip
R – C Procedure from I.M. 453.06 B, Apper	ndix A	1-1/8"	65.0 kip
Place fastener in Skidmore, use washer under "turned" element.		TAB	SLE 4
Need a minimum 3 to 5 exposed treads behind the nut. (NOTE: May use a or shim plates.)  2. Initially tension fastener to values in TABLE 1.	naximum of 3 washers &/or	Bolt Length	R – C Test Total Rotation
3. Match mark bolt tip, nut corner, washer/shims, and the Skidmore's base plate	e. (Mark shall be a	L ≤ 4D	2/3
straight-line.  4. Tighten fastener to at least MINIMUM specified tension in TABLE 2. (Include	any Skidmore correction	4D <l td="" ≤8d<=""><td>1</td></l>	1
factors.) This tension is required for a calculation in step 6 and is called "P" in	-	8D <l td="" ≤12d<=""><td>1-1/3</td></l>	1-1/3
Check total rotation for step 4. Should be about the same as rotation for Turi			
Record torque required to develop tension in step 4. (Torque is read with nut     Torque in step 5 must be less than "Maximum" torque.     "Maximum" torque is calculated by T = 0.25 x bolt dia/12 x P. If step 5's torque is calculated by T = 0.25 x bolt dia/12 x P.	ue is less than Maximum,	Bolt Dia Fraction	ameters Decimal
bolt and nut pass. If not, lot fails and entire lot may be relubricated and retes  7. Complete nut rotation as required by R – C Rotation listed in TABLE 4.	ted or else replaced.	3/4"	0.750"
Record tension at the end of step 7's added rotation. (Accounting for any Sk	idmore correction factors.)	7/8"	0.875
Step 8's tension must be greater than MINIMUM shown in TABLE 3. If it is g	· ·	1-1/8"	1.125"
If not, fastener lot fails. If lot fails due to tension being less than minimum she bolt lot may be relubricated and tested again. If bolt breaks during step 7, en replaced.		ASTM GRA	ADES FOR
Loosen nut, remove bolt, and inspect bolt and nut for visible signs of damage	1.		

01/29/01 Appendix 11-13.1

Damage could be thread stripping, nut does not run freely to location of test shims, nut is cracked, bolt is cracked in the threads, etc. If there is evidence of damage, the bolt lot is rejected & shall be replaced.

10. Conduct test on two randomly selected fasteners. Both tested fasteners must pass the R-C test to accept

that lot.

Blk & Galv

Black

Galvanized

Bolt A 325

Nut A 194

Nut A 563

Washer F 436



# **Iowa Department of Transportation**

**ROTATIONAL—CAPACITY TEST** Test Number\_ Short Bolt Procedure 1-5-95 Date (For bolts too short to be tested in a Skidmore.) Inspector \_ County\_ Project #\_ Design #\_ Calculations Fastener Type BLACK GALVANIZED Bolt diameter \*D\* = inches Field Relubricated for this test Yes\_\_\_\_ No\_ \_in.

Bolt Length =

\_\_\_\_inches
Misc. Information

1. OT NOOLDONE (I.I.VI. 400.00 B)		
Measured Torque at Snug Tight = ft-lbs		
Measured Torque after Initial Rotation = ft-lbs		
Is Torque < TABLE 3? Yes, Continue test No, R – C Lot Fails		
Complete R – C Test Rotation.  Total rotation required by R – C test given in TABLE 4.		
Condition of Fastener: Nut OK?, Bolt OK?, PASS?		
Production Lot# NOTES:  Bolts  Nuts  Washers  R - C Lot #		
R – C Procedure from I.M. 453.06 B, Appendix A		
Place fastener into an appropriate size hole in any available splice. Use washer/shims under "turned" element. Need a minimum 3 to 5 exposed threads behind the nut. (NOTE: May use a maximum of 3 washers &/or shim plates.)		
Initially tension fastener to values listed in TABLE 1.		
Match mark bolt tip, nut corner, washer/shims, and the base steel. (Mark shall be a straight line.)		
Tighten fastener to rotation specified in TABLE 2.		
NOTE: Same rotation required for Turn-of-Nut.		
5. Record torque when rotation in Step 4 is achieved. (Torque is read with nut in motion.)		
6. Torque shall not exceed values in TABLE 3. If Step 5's torque is LESS THAN "Maximum" allowable,		
fastener lot passes first phase of R - C testing. If torque is GREATER, fastener lot fails. Entire lot may be		

7. Complete nut rotation to total rotation required by TABLE 4. NOTE: Rotation is measured from initial

9. Conduct test on two randomly selected fasteners for each lot to be incorporated into the structure.

Damage could be thread stripping, nut does not run freely to location of test shims, nut is cracked, bolt is Cracked in the threads, etc. If there is evidence of damage, the bolt lot is rejected. Entire lot may be

reference marked in Step 3 and is 2 times the rotation required for Turn-of-Nut.

8. Loosen nut, remove bolt, and inspect bolt and nut for visible sighs of damage.

relubricated and retested or else lot is replaced and tested.

Relubricated and retested or else replaced and tested.

Both tested fasteners must pass the R - C test to accept that lot.

P \_ C PROCEDURE (LM 453 06 B)

### TABLE 1

Bolt Dia.	Initial Tension Range (ft-lbs)
3/4"	50 to 100
7/8"	80 to 160
1"	120 to 240
1-1/8"	150 to 300

#### TABLE 2

Bolt Length	Initial R – C (Turns)
L≤4D	1/3
4D <l td="" ≤8d<=""><td>1/2</td></l>	1/2
8D <l td="" ≤12d<=""><td>2/3</td></l>	2/3

### TABLE 3

Bolt Dia.	Max. Torque (ft-lbs)
5/8"	290
3/4"	500
7/8"	820
1"	1230
1-1/8"	1500

## TABLE 4

Bolt Length	Total R – C Turns
L≤4D	2/3
4D <l td="" ≤8d<=""><td>1</td></l>	1
8D <l td="" ≤12d<=""><td>1-1/3</td></l>	1-1/3

Bolt Diameters Fraction Decimal	
5/8"	0.625"
3/4"	0.750"
7/8"	0.875"
1-1/8"	1.125"

ASTM GRADES FOR		
Blk & Galv	Bolt A 325	
Black	Nut A 194	
Galvanized	Nut A 563	
Blk & Galv	Washer F 436	

01/29/01 Appendix 11-13.2



replaced.

# **Iowa Department of Transportation**

ROTATIONAL—CAPACITY TEST

Test Number\_\_\_

Long Bolt Procedure 1-5-95		
(For bolts long enough to be tested in a Skidmore.)		tor
County Project #	Design	1 #
Skidmore Correction Calcu	lations	
Calb. Ave <u>306</u> kip Gauge <u>30.0</u> kip Bolt diameter *D* = _	3/4	inches
Calb. Ave – Gauge = <u>+0.6</u> kip 4D = <u>3</u> in.		<u><b>6</b></u> in.
astener Type BLACK GALVANIZED Min. Adj. Tension =	Min. Tensior	n x 1.15
ield Relubricated for this test Yes_X_ No	Misc. I	nformation
R – C PROCEDURE (I.M. 453.06 B)	TAI	BLE 1
Bolt Length = 3 inches Read 28.4 kips	Bolt Dia.	Initial Tension
Corrected Skidmore Tension (P) = <u>28.4 + 0.6 = 29.0</u> kips	Buit Dia.	Range
	3/4"	3 to 5 kips
(Must be = to, or > than TABLE 2 Tension.) OK?Yes_	7/8"	4 to 6 kips
Measured Torque = <u>350</u> ft-lbs	1"	5 to 7 kips
Max. Permitted Torque = <u>453</u> ft-lbs T=0.25x_ <u>0.75</u> _ " x_ <u>29,000</u> bs	1-1/8"	6 to 8 kips
T < 0.25 x dia/12 x P Measured < Max OK?_ <b>Yes</b> 12"		BLE 2
*** Complete R – C Test Rotation. ***	1 Al	
(Should bring total rotation to 2x the rotation required by Turn-of-Nut.) Read _40.0 _kips	Bolt Dia.	Specification
		Min. Tension
Corrected Skidmore Tension = _40.0 + 0.6 = 40.6kips	3/4"	28.4 kip
(Must be > than TABLE 3 Tension) OK?_Yes	7/8"	39.3 kip
Condition of Fastener: Nut OK? Yes Bolt OK? Yes PASS? Yes		51.5 kip
		56.5 kip
	TAI	BLE 3
Production Lot# NOTES:		Min. Adj.
Bolts Nuts	Bolt Dia.	1
Washers		Tension
R – C Lot #	3/4"	32.7 kip
<del>=</del> -	7/8"	45.2 kip
	1"	59.2 kip
R – C Procedure from I.M. 453.06 B, Appendix A	1-1/8"	65.0 kip
Place fastener in Skidmore, use washer under "turned" element.	TAI	BLE 4
Need a minimum 3 to 5 exposed treads behind the nut. (NOTE: May use a maximum of 3 washers &/or	Bolt	R – C Test
or shim plates.)	Length	Total Rotation
Initially tension fastener to values in TABLE 1.     Marks made half to put account who self-times and the Stridgers's happy late. (Mark shall be a		
<ol><li>Match mark bolt tip, nut corner, washer/shims, and the Skidmore's base plate. (Mark shall be a straight-line.</li></ol>	L ≤ 4D	2/3
Tighten fastener to at least MINIMUM specified tension in TABLE 2. (Include any Skidmore correction	4D <l td="" ≤8d<=""><td>1</td></l>	1
factors.) This tension is required for a calculation in step 6 and is called "P" in the formula below.	8D <l td="" ≤12d<=""><td>1-1/3</td></l>	1-1/3
Check total rotation for step 4. Should be about the same as rotation for Turn-of-Nut.		
Record torque required to develop tension in step 4. (Torque is read with nut in motion.)     Torque in step 5 must be less than "Maximum" torque.		Diameters
o. Torque in step o must be less than Iviaximum torque.		Decimal
"Maximum" torque is calculated by T = 0.25 x bolt dia/12 x P. If step 5's torque is less than Maximum.	Fraction	
"Maximum" torque is calculated by $T = 0.25 \times \text{bolt dia}/12 \times \text{P}$ . If step 5's torque is less than Maximum, bolt and nut pass. If not, lot fails and entire lot may be relubricated and retested or else replaced.		0.750"
bolt and nut pass. If not, lot fails and entire lot may be relubricated and retested or else replaced.  7. Complete nut rotation as required by R – C Rotation listed in TABLE 4.	3/4"	0.750"
bolt and nut pass. If not, lot fails and entire lot may be relubricated and retested or else replaced.		0.750" 0.875 1.125"

ASTM GRADES FOR		
Blk & Galv	Bolt A 325	
Black	Nut A 194	
Galvanized	Nut A 563	
Blk & Galv	Washer F 436	

01/29/01 **Appendix 11-13.3** 

bolt lot may be relubricated and tested again. If bolt breaks during step 7, entire bolt lot fails and shall be

Damage could be thread stripping, nut does not run freely to location of test shims, nut is cracked, bolt is cracked in the threads, etc. If there is evidence of damage, the bolt lot is rejected & shall be replaced. 10. Conduct test on two randomly selected fasteners. Both tested fasteners must pass the R-C test to accept

9. Loosen nut, remove bolt, and inspect bolt and nut for visible signs of damage.